FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: **56957-040 (PVIK-3)**

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): 09/831516

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US99/24732	**25 October 1999**	**15 December 1998**

TITLE OF INVENTION
AERODYNAMIC METHOD FOR MAKING TISSUE PAPER

APPLICANT(S) FOR DO/EO/US
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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☒ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/831518	PCT/US99/24732	56957-040 (PVIK-3)

21. The following fees are submitted:.		CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :			
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO	$970.00		
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO	$840.00		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$690.00		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)	$670.00		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)	$96.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =		$860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).		$0.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	10 - 20 =	0	x $18.00	$0.00	
Independent claims	3 - 3 =	0	x $80.00	$0.00	
Multiple Dependent Claims **(check if applicable)**.			☐	$0.00	
TOTAL OF ABOVE CALCULATIONS =				$860.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**.			☐	$0.00	
SUBTOTAL =				$860.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	$0.00	
TOTAL NATIONAL FEE =				$860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	$0.00	
TOTAL FEES ENCLOSED =				$860.00	
				Amount to be: refunded	$
				charged	$

☒ A check in the amount of **$860.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **50-1133** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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38,573
REGISTRATION NUMBER

May 10 , 2001
DATE

AERODYNAMIC METHOD FOR MAKING TISSUE PAPER

FIELD OF THE INVENTION

The present invention relates to the field of papermaking, and more particularly, to a method of manufacturing tissue paper featuring enhanced absorbency.

BACKGROUND OF THE INVENTION

One of the main problems that one encounters when making tissue paper by an aerodynamic method without using binders is the ability to provide a tissue paper having both a high absorbency (hygroscopicity) and sufficient strength. This is so because when the aerodynamic method is used without binders, the bonding of fibers is obtained from hydrogen bonds formed as a result of pressure processing and subsequent drying of the moistened layer of fibers produced from aerosuspension. Pressing of the fibrous layer is necessary to provide a greater area of inter-fibrous contact, while a drying is required to remove water molecules and form the above-mentioned hydrogen bonds between the fibers. Thus, the greater the pressure, the stronger the tissue produced and the lower its absorbency, and vice versa.

One conventional aerodynamic method of paper making comprises forming of a layer of cellulose fibers out of aerosuspension, impregnating

this layer by a liquid reagent, and subsequently pressing and drying of this layer. See, for example, USSR Author's Certificate 1594237, IPC 5 D21H 23/00, 21/18, published August 23, 1990. This method is characterized by the use of 2 - 8% water solution of resorcin that provides much better swelling of fibers than water. Penetration of water into intercrystalline space of pulp fibers facilitates enhancement of their plasticity, which results in more complete contact of fibers during pressing and drying, and, hence, enhances the strength of fiber bonding. Since molecules of resorcin form bonds of a "cellulose-resorcin-cellulose" type, resorcin also performs the function of a binder, which also facilitates the enhancement of the produced tissue strength. Thus, when using a water/resorcin solution for moistening the fibrous layer, one can decrease the pressure applied at the stage of pressing, thereby improving tissue absorbency while preserving tissue strength. However, introduction of chemical additives makes tissue paper production more expensive.

Another conventional method for making high-absorbency products out of fibrous materials comprises forming of a multi-layer structure of thin paper layers and a layer of fibers produced out of aerosuspension and placed between paper layers. All the layers arranged in the above manner are pressed between rolls, one of which has a patterned surface. See, for example, USA patent 3908653, IPC 2 A61F 13/16, A61L 15/00, published September 30, 1975. Final formation of the product proceeds in the

following manner: two structures obtained in the above-described way are folded together facing each other with patterned surfaces and then the edges are jet-molded or glued together. Since the filler in the product comprises substantially non-pressed fibers, the final product offers high hygroscopicity, but the manufacturing cost of such products is very high.

One conventional aerodynamic method of papermaking, which is believed to be the closest to the present invention, comprises preparation of aerosuspension of cellulose fibers, forming a fibrous layer on a moving forming wire, moistening the moving fibrous layer with water, the amount of which constitutes 20 - 60 % of fiber weight, and subsequently pressing and drying of said fibrous layer. See, for example, USA patent 3949035, IPC 2 B29C 17/04, published April 6, 1976 - prototype. Pressing is performed between two rotating rolls, one of which has a patterned surface made in the form of ridges with flat faces of round (or circular) shape, and the distance between ridges doesn't exceed the average length of the cellulose fibers. During pressing, compaction of the fibrous layer and formation of greater contact area between the fibers take place in the ridge areas, while no compaction occurs in the areas between the ridges (i. e., in valleys). As a result, the final product obtained after drying has two types of areas: areas of a pressed fibrous layer that determine the strength of the tissue paper, and areas of non-pressed fibrous layer that determine tissue

absorbency. Thus, this method enables one to produce tissue paper, the structure of which concurrently provides tissue strength and hygroscopicity.

At the same time, to provide the formation of the above-mentioned inter-fibrous bonds, the formed fibrous layer should be moistened with a substantial amount of water. Besides, to provide better penetration of water into the fibrous layer, this moistening is accompanied by rarefaction of air produced underneath the wire carrying the fibrous layer. Such a moistening process requires amounts of water that are excessive compared to the amounts needed for the formation of inter-fibrous bonds. In addition, it takes an extra time to moisten the entire fibrous layer. All the above results in extra expenditures of energy (mainly expended on subsequent drying of the tissue paper web) and slows down the process of tissue production. Besides, removal of great amounts of water through drying leads to the shrinkage of the non-pressed part of the fibrous layer, which results in a decrease in absorbency of the produced tissue paper.

SUMMARY OF THE INVENTION

The present invention advantageously decreases the costs related to the manufacture of tissue paper and increases of the quality of the tissue paper.

According to an embodiment of the present invention, a method of making tissue paper comprises the following steps: preparing an

aerosuspension of fibrous material; forming a layer of fibers on a forming wire; transferring the layer of fibers to a profiling belt having a pressing surface containing protruding elements for impressing first areas of the fibrous layer in contact therewith; contacting the layer of fibers disposed on the pressing surface of the profiling belt with a moistening belt; and pressing the layer of fibers between the profiling belt and the moistening belt. In addition, the moistening belt has a lower sorption capacity than a sorption capacity of the first areas of the fibrous layer being impressed by the protruding elements and higher than a sorption capacity than second areas of the fibrous layer that are not impressed by the protruding elements.

According to the present invention, a distance between protruding relief elements on the pressing surface does not exceed an average length of the fibers. The formed layer of fibers can be placed on a profiling belt that has a pressing surface that faces the layer of fibers. Moistening of the formed layer of fibers is performed concurrently with the pressing step, an utilizes an additional belt such as, for example, a moistening belt. The moistening belt is disposed such that a pressing force is exerted concurrently on the profiling belt, the moistening belt, and the layer of fibers located therebetween. The moistening belt is preferably made of a material having a sorption capacity that is lower than a sorption capacity of those areas of the layer of fibers that are pressed due to the protruding

relief elements, but higher than the sorption capacity of the areas of the layer of fibers that are not pressed by the relief elements. The moistening belt can be saturated with an appropriate fluid such as, for example, water, in an area that is outside the pressing zone.

In one embodiment of the claimed invention, the fibrous layer placed between the profiling and moistening belts during the step of pressing. In the course of pressing, the sections of fibrous layer that are in the areas of protruding relief elements get compacted, which results in an increase of absorbency of the fibrous layer, due to the increase in the pressure of capillary absorption. When the fibrous layer absorbency reaches a value equal to the value of the same parameter of the moistening belt, the sections of the fibrous layer being compacted begin to absorb water from the moistening belt surface. With further compaction of the fibrous layer the excess water is squeezed out from the compacted sections into the non-compacted sections, and due to the difference in capillary absorption pressures, this water returns to the moistening belt. Part of the water returned will subsequently be absorbed by new sections of the layer of fibers being compacted. The moistening belt receives water required for moistening outside the pressing zone, for example, absorbing it when being passed through a tub with water.

The present invention provides concurrent moistening and pressing of the fibrous layer in order to minimize the amount of water required at the

pressing stage. Selective moistening of fibers only in the sections being compacted eliminates the requirement for moistening the entire fibrous layer, and excessive moistening. As a consequence, drying of the tissue paper web after the pressing step requires significantly lower expenditures of time and energy. Additionally, shrinkage of the tissue paper web is eliminated because the non-pressed sections of the fibrous layer are not moistened.

A wire made by means of interweaving threads can be used as the profiling belt. In this instance interweaving nodes represent the protruding relief elements of wire surface, and the shape of flat areas can be endowed through the use of smoothing. This approach can significantly reduces the cost of the process of the present invention.

Another simple and inexpensive embodiment of a moistening belt comprises a fine-mesh wire. In this instance sorption properties of the moistening belt are determined by surface properties of the material of the wire, as well as by relative sizes and geometrical configurations of threads and openings of the wire.

Further, longitudinal twisting of fibers that significantly decreases the area of contact between fibers in the areas pressed can be prevented if the prepared aerosuspension has a moisture content sufficient for causing saturation of fibers' walls with moisture.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a process diagram illustrating the process of moistening and pressing of a fibrous layer according to an embodiment of the present invention.

Fig.2 is a top plan view illustrating a profiling belt made in the form of wire, having smoothed surfaces of nodes produced by intersections of threads.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 1, a pressing unit of a paper-making machine that uses the method of the present invention comprises a roller press having two pressure rollers 1 and 2, a profiling belt 3, a moistening belt 4, and a tub 5 with water into which a drum 6 is submerged. The drum 6 is intended for transporting the moistening belt 4 through the tub 5. Fig. 1 also shows a forming wire 7 on which fibrous layer 8 is formed, a drying drum 9, and wire-driving rollers and take-up suction rolls 10 and 11.

The profiling belt 3, a fragment of which is shown in Fig. 2, can be made out of wire comprising interweaving threads 12 and wefts 13 of round (circular) cross-section. The nodes of this wire on the side contacting the fibrous layer are smoothed to such an extent that flat pressing surfaces 14 of elliptic shape are produced, and said flat pressing surfaces 14 determine the fibrous layer sections to be pressed. Geometric size of the wire and

the surfaces 14 are selected so that a distance between the surfaces 14 of juxtaposed nodes of the wire doesn't exceed an average length of the fibers. The strongest paper retaining good absorbing properties can be produced when this distance is approximately equal to half of the average length of the fibers. In this instance the individual fibers interconnect with each other and transmit mechanical stresses arising in the conditions of paper break from one pressed area to another.

Fibrous layer 8 formed out of aerosuspension (forming prccess is not shown in Fig.1) through the use of the forming wire 7 and the profiiing belt 3 is supplied to a zone of the suction roll 10 where the forming wire 7 breaks away, and the side of the fibrous layer 8 that has just lost contact with the forming wire is covered by the moistening beit 4. Such a forming belt can be made, for instance, in the form of a fine-mesh wire. The fibrous layer 8, now positioned between the profiling belt 3 and the moistening belt 4, is then fed to a pressing operation between rolls 1 and 2. Pressing of the fibrous layer 8 proceeds as described in the Summary of the Invention above. Subsequent to pressing, the belt 4 breaks away in the area of a take-up suction roll 11, and the pressed fibrous layer is fed to the drying drum 9, from which the finished paper web is subsequently obtained.

The possibility of implementing the claimed method was experimentally tested in a following manner.

Samples of tissue paper with specific weight of 40 - 45 g/m^3 were produced. Softwood and hardwood sulfate bleached pulp (with the average length of fibers 2.7mm and 1.4 mm, respectively) were used as fibrous semi-finished material.

An aerosuspension of fibers was prepared out of fibrous semi-finished material that has been moistened in advance to a moisture content of 50%. This aerosuspension was fed to the forming wire where a fibrous layer having a specific weight of 15 - 20 kg/m^3 was formed. A wire of interwoven synthetic threads 0.25mm in diameter and with the distance of 0.25 mm between core threads and 0.3 mm between weft threads was used as forming wire.

The formed fibrous layer (the moisture content of which was 30 - 35% at this technological stage) was transported to the profiling belt represented by standard metal wires #1 or #2 of simple interweaving generally used in papermaking industry. Wire #1 is woven out of flat threads, and the shape of its meshes is square. There are eight threads per 1 cm of running length, thread width is equal to 0.6 mm; thread thickness = 0.15 mm; distance between threads = 0.65 mm, and the area of threads constitutes 70% of the total wire area.

Wire #2 is woven out of threads of round section and of diameter 0.5 mm, and the shape of its meshes square. There are eight threads per 1

cm of running length, and the distance between threads is 0.75 mm. One surface of wire #2 was smoothed up to a depth of 0.25mm. Flat areas of elliptical shape, the total area of which constitutes 40% of the total wire area, were produced as a result of the smoothing. The fibrous layer was placed on the smoothed wire surface at the pressing stage.

Two fine-mesh wires joined together were used as a moistening belt. Each fine-mesh wire is made by simple interweaving of threads 0.25 mm in diameter, and there are 24 threads per 1 cm of running length. Moisture capacity defined as the amount of water retained by capillary forces in the wire of area 1 m^2 constitutes 0.08 kg/m^2.

The formed fibrous layer placed between the profiling wire (#1 or #2) and moistening wires was fed into the gap between the rolls of a roller press developing a force of 10 or 18 kg on 1cm of layer width. Subsequent to pressing, the moistening wires were taken off the fibrous layer, while the layer being held by profiling wire was fed to drying unit, the surface of which was heated to the temperature of 115 C.

Results of experimental testing are given in the Table below.

	Specific ravity of the layer of fibers, kg/m³	Moisture content of fibers on the forming wire, %	of profiling wire	Pressing force, kg	Moisture content of fibers after pressing, %	Tensile strength of paper sample, N/m	Moisture capacity of paper sample, kg of water per kg of absolutely dry fibers
1	0.04	35	1	10	52	600	2.2
2	0.045	35	1	10	54	550	2.1
3	0.04	30	1	18	43	850	1.9
4	0.04	32	1	18	45	870	1.9
5	0.04	35	1	18	47	960	1.9
6	0.045	30	1	18	45	840	1.8
7	0.045	35	1	18	48	850	1.8
8	0.04	30	2	10	48	550	2.3
9	0.04	35	2	10	51	550	2.2
10	0.045	30	2	10	49	620	1.8
11	0.045	35	2	10	50	640	1.9
12	0.04	30	2	18	48	670	2.2
13	0.04	35	2	18	51	700	2.1

The experiments performed confirm the possibility of implementing the method of the present invention and verified the above-indicated results. Using this method, it is possible to make tissue paper offering such strength and hygroscopic properties that correspond to the current specifications for tissue paper making. It should be pointed out that the amounts of water expended with this method are significantly less compared to the amounts spent when using other known methods. It can

be seen from the above Table that moisture content of the fibrous layer fed to drying subsequent to pressing varies only slightly compared to the moisture content of fibrous layer on the forming wire, which significantly reduces the cost of drying and decreases the shrinkage of paper web during drying.

Results of the experiments also indicate how parameters of technological process and equipment units exert influence on the final result. For example, when using wire #1 which is made out of flat threads and which has "shallow" relief formed by the interwoven nodes of threads, greater pressure should be applied to obtain required strength properties of the final product.

On the other hand, to obtain a required strength of tissue paper, quite high pressure is also needed when using wire #2 that is made of round threads and that has lesser area of pressing zones compared to wire #1. However, it is just the lesser area of pressing zones that makes it possible to obtain tissue paper offering greater absorbency than the tissue paper produced using wire #1.

Results of experiments given in the above Table in the 3rd, 4th, and 5th lines confirm that initial moisture content of a fibrous layer fed to a pressing operation also exerts impact on the strength of tissue paper being manufactured. The greater the moisture content of the fibers, the softer

and less twisted are they. Therefore, the contact area of such fibers is greater in the course of pressing. This fact results in the formation of inter-fibrous bonds on greater area, and, hence, in stronger tissue paper, while absorbency of such tissue paper remains the same.

While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. An aerodynamic method of making tissue paper comprising the steps:

(a) preparing an aerosuspension of fibrous material;

(b) forming a layer of fibers on a forming wire;

(c) transferring the layer of fibers to a profiling belt having a pressing surface containing protruding elements for impressing first areas of the fibrous layer in contact therewith;

(d) contacting the layer of fibers disposed on the pressing surface of the profiling belt with a moistening belt: and

(e) pressing the layer of fibers between the profiling belt and the moistening belt;

wherein the moistening belt has a lower sorption capacity than a sorption capacity of the first areas of the fibrous layer being impressed by the protruding elements and higher than a sorption capacity of second areas of the fibrous layer that are not impressed by the protruding elements.

2. The method of Claim 1, wherein the step of transferring comprises a step of transferring the layer of fibers to a profiling belt having a pressing surface containing protruding elements for impressing first areas of the fibrous layer in contact therewith, and a distance between

mutually-adjacent protruding elements is not greater than an average length of individual fibers of the layer of fibers.

3. The method of claim 1, wherein the step of transferring is performed using a profiling belt that comprises a wire made of threads interwoven such that nodes formed by said interwoven threads form the protruding elements of the pressing surface, and the protruding elements having relatively flat surface areas contacting the layer of fibers.

4. The method of claim 1, wherein the step of contacting comprises a step of contacting the layer of fibers disposed on the pressing surface of the profiling belt with a moistening wire.

5. The method of claim 1, wherein the step preparing an aerosuspension comprises a step of preparing an aerosuspension of fibrous material having a moisture content that provides saturation of walls of the fibers.

6. An apparatus for making tissue paper by an aerodynamic method, the apparatus comprising:

a forming wire for receiving an aerosuspension of fibers and forming a layer of fibers thereon;

a profiling belt having a pressing surface comprising protruding elements configured and arranged for contacting first areas of said layer of fibers, thereby impressing the first areas of said layer of fibers;

a moistening belt comprising a material having a sorption capacity lower than a sorption capacity of the first areas of said layer of fibers, and higher than a sorption capacity of second areas of said layer of fibers that are not contacted by said protruding elements; and

a pressing assembly for impressing the layer of fibers between the profiling belt and the moistening belt.

7. The apparatus of claim 6, wherein said pressing assembly comprises a pair of pressure rollers for exherting a force on the layer of fibers, the profiling belt, and the moistening belt.

8. The apparatus of claim 6, wherein a distance between mutually-adjacent protruding elements of the pressing surface of said profiling belt is not greater than an average length of individual fibers of the layer of fibers.

9. The apparatus of claim 6, wherein the protruding elements of said pressing surface have elliptical profiles.

10. An aerodynamic method for tissue paper making comprising the steps: preparing an of aerosuspension out of cellulose fibers or other fibrous material, forming of a layer of fibers on a moving forming wire;

moistening the formed layer of fibers; and

and pressing and drying said formed layer;,

wherein the pressing is performed by a pressing means having a pressing surface, for contacting with said layer of fibers, which is made as a relief surface and the distance between the protruding relief elements on the pressing surface doesn't exceed the average length of fibers; and,

wherein the method is distinguished by the fact that during pressing, the formed layer of fibers is placed on an additional profiling felt, the surface of which facing said layer of fibers represents said pressing surface, and moistening of the formed layer of fibers is performed concurrently with pressing for which purpose an additional moistening felt is used, and said moistening felt is accommodated in such a way

that pressing action is exerted concurrently on profiling and moistening felts and on the layer of fibers located between said feits, and such a material is used as a moistening felt the sorption capacity of which is lower than sorption capacity of those areas of said layer of fibers that are pressed due to the protruding relief elements, and at the same time the sorption capacity of said material is higher than the areas of said layer of fibers that are non-pressed by said relief elements, and saturation of moistening felt with water is performed outside the pressing zone.

ABSTRACT

An aerodynamic method of making tissue paper comprises the steps of preparing an aerosuspension out of cellulose fibers, forming a layer of fibers on a forming wire, moistening the formed layer of fibers and pressing and drying of said formed layer. The step of moistening the layer of fibers is performed concurrently with the step of pressing, for which purpose the layer of fibers is placed between the profiling and moistening belts. The surface of the profiling belt comprises protruding elements, wherein a distance between two mutually-adjacent protruding elements doesn't exceed an average length of the fibers. A wire with smoothed nodes of interweaving threads can be used as the profiling belt, while fine-mesh wire can be used as a moistening belt. Selective moistening of fibers only in the areas being pressed eliminates moistening of the entire layer, and drying of the paper web requires significantly less expenditures of time and energy. Shrinkage of the paper web is also minimized because the non-pressed areas of fibrous layer don't practically get moistened.

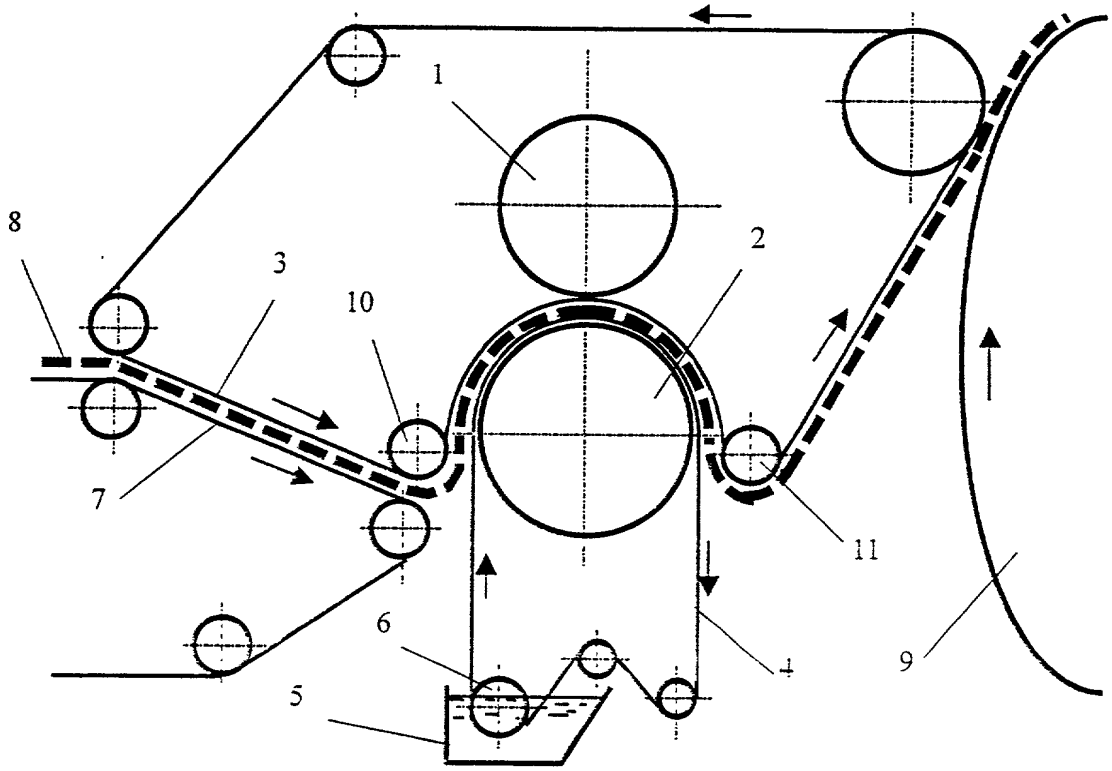

Fig. 1

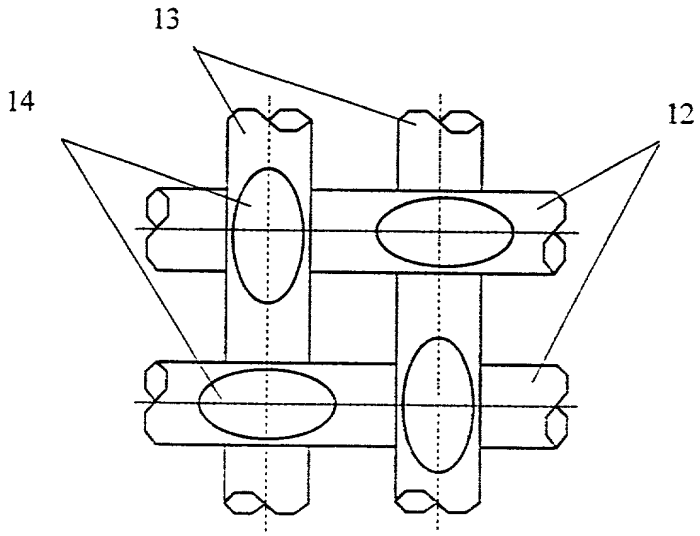

Fig. 2

Docket No.
56957-040 (PVIK-3)

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

AERODYNAMIC METHOD FOR MAKING TISSUE PAPER

☐ the specification of which

(check one)

☐ is attached hereto.

☒ was filed on **May 10, 2001** as United States Application No. or PCT International Application Number **09/831,516**

and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
98122569	**Russia**	**15 December 1998**	☐
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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